

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT**

**ASPHALT CONTENT BY IGNITION
ITM No. 586-08T**

1.0 SCOPE.

- 1.1** This method of test method covers the procedure for determination of the asphalt content by ignition in a furnace. The aggregate remaining after ignition may be used to evaluate the gradation of the aggregate in the mixture.
- 1.2** The values stated in either acceptable English or SI Metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI Metric units are shown in parenthesis. The values in each system may not be exact equivalents; therefore, each system shall be used independent of the other, without combining values in any way.
- 1.3** This procedure may involve hazardous materials, operations and equipment and may not address all of the safety problems associated with the use of the test method. The user of this ITM is responsible for establishing the appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 AASHTO Standards.

- T 30 Mechanical Analysis of Extracted Aggregate
- M 231 Weighing Devices Used in the Testing of Materials

2.2 ITM Standards.

- 572 Drying HMA Mixture
- 580 Sampling HMA
- 587 Reducing HMA Samples to Testing Size
- 802 Random Sampling

2.3 OTHER.

- Ignition Oven Operations Manual

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE.

- 4.1** This ITM shall be used to determine the asphalt content and gradation of the HMA mixture by an ignition oven.
- 4.2** A mix calibration factor shall be determined for each HMA mixture in a specific oven to account for any loss of aggregate during ignition and any variability between ovens that may occur.
- 4.3** Each mix calibration factor is unique to an individual ignition oven and not transferable.

5.0 APPARATUS.

- 5.1** Balance, Class G2, in accordance with AASHTO M 231
- 5.2** Bowls, spatulas, pans, and wire brushes as required
- 5.3** Catch pan, sufficient size to hold the sample basket(s) so that aggregate particles and melting asphalt falling through the screen mesh are caught
- 5.4** Ignition Oven, meeting the following requirements:
 - 5.4.1** Forced air ignition furnace capable of maintaining a temperature of $1100 \pm 9^{\circ}\text{F}$ ($578 \pm 5^{\circ}\text{C}$)
 - 5.4.2** Internal balance, thermally isolated from the oven chamber, and accurate to 0.1 g over the range of use
 - 5.4.3** Capacity to accommodate a sample size of 3500 g
 - 5.4.4** Door designed to refuse entry during the ignition test
 - 5.4.5** Equipped to minimize emissions during the ignition test
 - 5.4.6** Vented into a hood or to the outside
 - 5.4.7** Fan capable of pulling air through the furnace to expedite the test
 - 5.4.8** Automatic shut off that may be set at 0.01% of the sample weight (mass)
 - 5.4.9** Alarm indicating when a test is complete
- 5.5** Oven, capable of maintaining the temperature at $250 \pm 9^{\circ}\text{F}$ ($120 \pm 5^{\circ}\text{C}$)

5.6 Safety Equipment as follows:

5.6.1 Safety glasses or face shield

5.6.2 High temperature gloves

5.6.3 Long sleeve jacket

5.6.4 Heat resistant surface capable of withstanding 1202°F (650°C)

5.6.5 Protective cage capable of surrounding the sample baskets during the cooling period

5.7 Sample Basket(s), of appropriate size that allows the samples to be thinly spread and allows air to flow through and around the sample particles. Sets with two or more baskets shall be nested. The sample shall be completely enclosed with screen mesh, perforated stainless steel plate, or other suitable material.

6.0 CALIBRATION PROCEDURE.

6.1 The Contractor shall prepare all calibration samples as shown below.

6.2 Obtain aggregate material and asphalt for the HMA mixture as shown on the DMF/JMF.

6.3 Determine the weight (mass) required for the calibration samples. The samples shall not be more than 500 g greater than the minimum recommended sample size indicated in the following table:

Mixture Designation Size	Minimum Recommended Sample Weight (Mass), g
4.75 mm	1200
9.5 mm	1200
12.5 mm	1500
19.0 mm, OG 19.0	2000
25.0 mm, OG 25.0	3000

6.4 Prepare all replicate calibration samples of the HMA mixture in accordance with the mix design.

- 6.5** Butter the mixing bowl with the first sample for each mixture and discard the mixture after mixing.
- 6.6** Determine and record the weight (mass) required for each aggregate fraction and asphalt based on the percentages in the DMF/JMF.
- 6.7** Heat the asphalt to the temperature recommended by the manufacturer. Combine and mix the aggregate fractions until a uniform blend is obtained. Stir in the asphalt until the aggregate is uniformly coated.
- 6.8** Select 1000°F (538°C) or 900 °F (482°C) for the calibration test. If dolomite is used in the mix, 800°F (427°C) may be used for the calibration test.
- 6.9** Submit four calibration samples and the information in 6.6 and 6.8 to the District
- 6.10** Determine the calibration factor for a specific oven for a specific HMA mixture as follows:
 - 6.10.1** Test at least two of the calibration samples in accordance with 8.0. If dolomite is used in the mixture in accordance with 6.8, test all four of the calibration samples.
 - 6.10.2** Record the calibrated asphalt content to the nearest 0.01 percent for each calibration sample.
 - 6.10.3** Calculate the sample calibration factor as the difference between the calibrated asphalt content and the design asphalt content for each sample.
 - 6.10.4** If dolomite is used in the mix in accordance with 6.8, follow 6.10.4 c, otherwise, follow 6.10.4 a and 6.10.4 b.
 - a)** If the difference between the two sample calibration factors is less than 0.15 percent, then the mean of the two sample calibration factors may be determined and reported as the mix calibration factor.
 - b)** If the difference between the two calibration factors is more than 0.15 percent, two additional calibration samples will be tested. Discard the highest and lowest sample calibration factors from the four values, then determine and report the mean of the remaining two sample calibration factors as the mix calibration factor.
 - c)** Determine and report the mean of the four sample calibration factors as the mix calibration factor.

7.0 SAMPLING PROCEDURE. Sampling shall conform to the requirements of ITM 580.

8.0 ASPHALT CONTENT PROCEDURE.

- 8.1** Set the stability threshold value of the ignition oven to 0.01 percent weight (mass) loss for three minutes. Record the stability threshold value as set.
- 8.2** Program the oven to provide a ticket. Check the printer and ensure paper is installed.
- 8.3** Preheat the ignition oven to the test temperature. Record the test temperature.
- 8.4** Record the mix calibration factor in percent for the mixture at the specified temperature
- 8.5** Dry the specimen to constant weight (mass) in accordance with ITM 572
- 8.6** Weigh the sample and determine if the sample meets the size requirements specified at 6.3
- 8.7** If needed, reduce the sample to the correct size in accordance with ITM 587
- 8.8** Measure and record the weight (mass) of the ignition oven basket assembly using the external balance
- 8.9** Place the bottom basket inside the catch pan on top of the scale and tare out the scale
- 8.10** Place the first half of the sample in the bottom basket. Spread the sample evenly over the bottom of the basket ensuring the material is not in contact with the sides of the basket.
- 8.11** Place the top basket on the bottom basket and tare out the scale.
- 8.12** Place the second half of the sample in the top basket. Spread the sample evenly over the bottom of the basket ensuring the material is not in contact with the sides of the basket.
- 8.13** Repeat 8.12 and 8.13 for additional baskets as required
- 8.14** Complete the ignition oven basket assembly by attaching the lid and guards
- 8.15** Measure and record the weight (mass) of the ignition oven basket assembly with the dry sample using the external balance

- 8.16** Calculate the weight (mass) in grams of the dry sample using the following formula.

$$W_1 = W_2 - W_3$$

where:

W_1 = weight (mass) of the dry HMA sample, g

W_2 = weight (mass) of ignition oven basket assembly with dry HMA sample, g

W_3 = weight (mass) of ignition oven basket assembly, g

- 8.17** Enter the mix calibration factor and the weight (mass) in grams of the dry sample into the ignition oven computer in accordance with the Ignition Oven Operations Manual.
- 8.18** Place the ignition oven basket assembly and dry sample in the ignition oven in accordance with the Ignition Oven Operation Manual.
- 8.19** Verify that the weight (mass) of the sample baskets displayed on the oven scale is within ± 5 g of the weight on the external balance. (Differences > 5 g or failure of the oven scale to stabilize may indicate that the sample baskets are contacting the oven wall)
- 8.20** Burn the dry sample in the ignition oven until the oven shuts off automatically.
- 8.21** Remove the ignition oven basket assembly and burned sample from the ignition oven. Place the assembly on a firm heat resistant surface. Cover the assembly with a protective cage and allow the sample to cool to about room temperature.
- 8.22** Remove the ignition oven ticket from the ignition oven console. Record the calibrated asphalt content from the ticket to the nearest 0.01%.
- 8.23** Cool the ignition oven basket assembly to room temperature.
- 8.24** Determine and record the weight (mass) of the ignition oven basket assembly and burned aggregate.

- 8.25** In cases when an ignition oven ticket is unavailable or there was an error in the ticket, calculate the asphalt content of the sample by the following formula:

$$AC, \% = \left(\frac{W_2 - W_1}{W_2} \right) \times 100 - C_1$$

where:

AC % = the measured (corrected) asphalt content

W_1 = weight (mass) of the dry HMA sample, g

W_2 = weight (mass) of the HMA sample prior to ignition, g

C_1 = calibration factor, percent by weight of HMA sample

9.0 AGGREGATE GRADATION PROCEDURE.

- 9.1** The starting weight (mass) of the aggregate for AASHTO T 30 is determined by 9.2 or 9.3, depending on the decant procedure used.

9.2 Decant in Ignition Oven Sample Basket.

- 9.2.1** Determine and record the weight (mass) of the ignition oven basket assembly and the aggregate using the external scale

- 9.2.1** Calculate the starting weight (mass) of the aggregate for decanting by the following formula:

$$W_1 = W_2 - W_3$$

where:

W_1 = weight (mass) of aggregate, g

W_2 = weight (mass) of ignition oven basket assembly and aggregate, g

W_3 = weight (mass) of ignition oven basket assembly, g

9.3 Decant in Container.

- 9.3.1** Determine and record the weight (mass) of the container.

- 9.3.2** Carefully dump the aggregate into the container. Clean the baskets with a brush to collect all loose material.

- 9.3.3** Determine and record the weight (mass) of the new container and aggregate.

- 9.3.4** Calculate the starting weight (mass) of the aggregate for the decant by the following formula:

$$W_1 = W_2 - W_3$$

where:

W_1 = weight (mass) of burned aggregate, g

W_2 = weight (mass) of new container and burned aggregate, g

W_3 = weight (mass) of new container, g

- 9.4** Determine the gradation of the aggregate in accordance with AASHTO T 30

10.0 REPORT.

- 10.1** Report the test temperature, mix calibration factor, and the absorption factor for mix calibration tests.

- 10.1** Report the calibrated asphalt content, test temperature, the mix calibration factor, the temperature correction factor and the oven number for the mix acceptance tests. Attach the ignition oven ticket to the report.

- 10.2** Report the weight (mass) retained on each sieve and the percent passing on each sieve, for aggregate gradation tests.